INTEGRATED CROSS EXCHANGE UNIT AND A METHOD OF THE SERVICE DISPATCHING

Field of the Invention

The present invention relates to cross-connecting and switching technology of TDM (Time Division Multiplexing) service and data service in communication systems.

Background of the Invention

As the data service increases, the conventional SDH (Synchronous Digital Hierarchy) transmission technology also has corresponding advancement. The Next Generation SDH (NG SDH) technology represented by virtual concatenation, LCAS (Link Capacity Adjustment Scheme) and GFP (Generic Framing Procedure) accelerates the evolution of conventional SDH devices mainly-designed for TDM service to the direction of MSTP (Multi-Service Transmission Platform).

In MSTP devices, switching of data service between different boards can be implemented through adding data switching function, and accordingly, the demand of incremental data service can be satisfied.

At present, almost all data switching and TDM cross-connecting are implemented on different boards; some solutions can accomplish data/TDM integrated switching, but these solutions have some problems, the most important one of which is they need line boards to implement identification of data service, and even de-mapping and de-encapsulation; in this way, the virtual concatenation service in different lines can

not be supported.

FIG.1 shows a data switching solution of the prior art. In this solution, a data service processing unit transmits the data as required to be switched to a data switching unit via data bus to implement switching; a line unit implements separation of data service and TDM service on SDH lines, so that the data service gets to the data switching unit via the data bus to be switched, and the TDM service is crossed by a cross-connecting unit.

The data switching unit may has functions of encapsulating and mapping data service to SDH container, here the data switching unit is connected with the cross-connecting unit by the bus.

It can be seen from the above, the prior art has following disadvantages:

(1) The cross-connecting unit for TDM service and the Switching Unit for data service are separated, low-integration, and occupying relatively more system slots;

(2) The line unit needs to implement separation of data service and TDM service, in the circumstances of virtual concatenation, the same service is possible to born at different line units through different routes, then the line unit can not implement separation of data service and TDM service.

Summary of the Invention

In view of the disadvantages of the prior art, an embodiment of the present invention aims to provide an integrated cross-switching unit to integrate the functions of

TDM cross-connecting and data switching into the same unit, which reduces the demand of system slots; another embodiment of the present invention aims to provide a service scheduling method using the above integrated cross-switching unit.

The integrated cross-switching unit according to an embodiment of the present invention, used for SDH system comprising an SDH line unit and a data service processing unit, including: a bus identification module, a cross-connecting module, a mapping/de-mapping module, an encapsulation/de-encapsulation module, and a packet scheduling module; wherein

the bus identification module transmits the data service and/or TDM service from the SDH line unit to the cross-connecting unit and transmits the data service from the data service processing unit to the packet scheduling module;

the cross-connecting module implements cross-scheduling for time slots of the TDM service, and schedules the time slots corresponding to the data service from the SDH line unit to the mapping/de-mapping module;

the mapping/de-mapping module receives data frames from the cross-connecting module, and implements mapping for the data from the encapsulation/de-encapsulation module;

the encapsulation/de-encapsulation module receives the data frames from the mapping/de-mapping module, implements data link layer de-encapsulation, and encapsulates the packets from the packet scheduling module;

the packet scheduling module receives the data packets

from the encapsulation/de-encapsulation module and/or the bus identification module to implement packet scheduling based on label; transmitting the scheduled data to the data service processing unit via packet bus or to the SDH line unit via the encapsulation/de-encapsulation module, the mapping/de-mapping module and the cross-connecting unit in turn.

Preferably, multiple physical channels are configured between the mapping/de-mapping module and the encapsulation/de-encapsulation module, and between the encapsulation/de-encapsulation module and the packet scheduling module.

Preferably, the multiple physical channels are respectively configured with different encapsulation protocols.

Preferably, for the GFP frames from different physical channels, the encapsulation/de-encapsulation module finds CID field in the extended header of each GFP frame and forwards directly the data frame with the CID field into the corresponding physical channel.

Another aspect of the present invention aims to provide an integrated cross-switching unit, used for SDH system including an SDH line unit and a data service processing unit, including: a bus identification module, a high-order cross-connecting module, a high-order mapping/de-mapping module, a high-order encapsulation/de-encapsulation module, a high-order packet scheduling module, a low-order cross-connecting module, a low-order mapping/de-mapping

module, a low-order encapsulation/de-encapsulation module, and a low-order packet scheduling module; wherein

the bus identification module transmits the data service and/or TDM service from the SDH line unit to the high-order cross-connecting unit, and transmits the data service from the data service processing unit to the high-order packet scheduling module;

the high-order cross-connecting module schedules the service as required for low-order processing to the low-order cross-connecting module, implements cross-scheduling for time slots of high-order TDM service, and schedules the time slots corresponding to the high-order data service from the SDH line unit to the high-order mapping/de-mapping module;

the low-order cross-connecting module implements cross-scheduling for time slots of low-order TDM service, and schedules the time slots corresponding to low-order data service from the SDH line unit to the low-order mapping/de-mapping module;

the high-order and low-order mapping/de-mapping modules receive the data frames from the high-order and low-order cross-connecting modules correspondingly, and implement mapping for the data from the high-order and low-order encapsulation/de-encapsulation modules respectively;

the high-order and low-order encapsulation/de-encapsulation modules receive the data frames from the high-order and low-order mapping/de-mapping modules correspondingly, implement data link layer

de-encapsulation, and encapsulate the packets from the high-order and low-order packet scheduling modules;

the high-order packet scheduling module receives the data packets from the high-order encapsulation/de-encapsulation module and/or the bus identification module and implements packet scheduling based on label; transmitting the scheduled data to the data service processing unit via packet bus or to the SDH line unit via the high-order encapsulation/de-encapsulation module, the high-order mapping/de-mapping unit and the high-order cross-connecting module in turn;

the low-order packet scheduling module receives the data packets from the low-order encapsulation/de-encapsulation module and implements packet scheduling based on label; transmitting the scheduled data to the SDH line unit via the low-order encapsulation/de-encapsulation module, the low-order mapping/de-mapping unit and the low-order cross-connecting module in turn. The low-order packet scheduling module receives the data packets from the low-order encapsulation/de-encapsulation module and implements packet scheduling based on label; the data after scheduling are transmitted to the data service processing unit through Packet Bus or get to the SDH Unit through low-order encapsulation/de-encapsulation module, low-order Mapping/De -mapping Unit and low-order cross-connecting module in turn.

A further aspect of the present invention aims to provide a service scheduling method implemented by the above integrated cross-switching unit, including the steps of:

A) the bus identification module transmitting the data service and/or TDM service from the SDH line unit to the cross-connecting module, and going to step B); transmitting the data service from the data service processing unit to the packet scheduling module, and going to step C);

B) the cross-connecting module implementing cross-scheduling for time slots of the TDM service, and transmitting the scheduled data to the SDH line unit; or scheduling the time slots corresponding to the data service from the SDH line unit to the mapping/de-mapping module, the encapsulation/de-encapsulation module receiving the data service from the mapping/de-mapping module and transmitting the data service to the packet scheduling module, and going to step C);

C) the packet scheduling module implementing packet scheduling for the data service; transmitting the scheduled data to the data service processing unit via packet bus, or to the SDH line unit via the encapsulation/de-encapsulation module, the mapping/de-mapping module and the cross-connecting module in turn.

Preferably, the bus identification module reports the slot number corresponding to the data service processing unit and unit type of the data service processing unit to the control unit via the data service processing unit, and identifies the type of the bus connected with the processing unit as backplane packet bus to identify service source.

Preferably, the SDH line unit and the data service processing unit copy the service to a first integrated

cross-switching unit and a second integrated cross-switching unit which have completely same function and structure to implement the same service scheduling procedure; if the first integrated cross-switching unit and the second integrated cross-switching unit are both normal, the SDH line unit and the data service processing unit receive the same service streams from the first integrated cross-switching unit and the second integrated cross-switching unit , and select either of them to implement a processing based on the service streams; if either of the first integrated cross-switching unit and the second integrated cross-switching unit goes wrong, the faulted integrated cross-switching unit reports to the control unit, and the control unit instructs the SDH line unit and the data service processing unit to select the service stream of the normal integrated cross-switching unit.

Preferably, the SDH line unit and the data service processing unit copy the service to the first integrated cross-switching unit and the second integrated cross-switching unit which have completely same function and structure to implement the same service scheduling procedure; the SDH line unit and the data service processing unit receive the same service streams from the first integrated cross-switching unit and the second integrated cross-switching unit, and determine whether the two service streams are normal, select either of them and implement a processing based on the service streams if the two service streams are both normal; if either of them is abnormal, select the normal service stream.

Preferably, the SDH line unit and the data service

processing unit allocate the service to the first integrated cross-switching unit and the second integrated cross-switching unit which have completely same function and structure to implement service scheduling; if the first integrated cross-switching unit and the second integrated cross-switching unit are both normal, the SDH line unit and the data service processing unit receive the service streams from the first integrated cross-switching unit and the second integrated cross-switching unit to implement a processing based on the service streams; if either of the first integrated cross-switching unit and the second integrated cross-switching unit goes wrong, the faulted integrated cross-switching unit reports to the control unit, and the control unit instructs the SDH line unit and the data service processing unit to switch the service allocated to the faulted integrated cross-switching unit to the normal integrated cross-switching unit.

Preferably, the SDH line unit and the data service processing unit allocate the service to the first integrated cross-switching unit and the second integrated cross-switching unit which have completely same function and structure to implement service scheduling; the SDH line unit and the data service processing unit receive the service streams from the first integrated cross-switching unit and the second integrated cross-switching unit and determines whether the service streams are normal; if either of the service streams is abnormal, switch the service of the integrated cross-switching unit corresponding to the abnormal service stream to the normal integrated cross-switching unit.

Preferably, the service allocated to the first integrated cross-switching unit and the second integrated cross-switching unit has priority; when either of the integrated cross-switching units goes wrong and needs service switching, the high-priority service can substitute the low-priority service under processing.

Compared with the prior art, the advantageous effect of the present invention include: first, an embodiment of the present invention provides an integrated cross-switching unit in a system, which saves system slots using the integrated cross-switching unit under the precondition of implementing the same data switching. Secondly, since an embodiment of the present invention includes a bus identification module for identifying service source, and a cross-connecting module can implement separation of TDM service and data service, so the line unit and the data service processing unit can be simplified and support virtual concatenation.

Embodiments of the present invention can provide service scheduling on GFP level without de-encapsulation, reducing scheduling time and implementation cost.

Embodiments of the present invention can realize multi-granularity mapping/de-mapping;

Embodiments of the present invention can support multiple encapsulation protocols and respectively configure each channel with a different encapsulation protocol.

Embodiments of the present invention also can reduce complexity of the data service processing unit, when the access

quantity of service is relatively large, it can reduce the total cost of the system effectively.

It is easier for embodiments of the present invention to realize relatively large service scheduling capacity through separation of high-order service and low-order service.

Embodiments of the present invention can directly connect the packet service from the service processing unit to the packet scheduling unit to implement scheduling through identification of backplane bus.

Brief Description of the Drawings

FIG.1 is a schematic diagram illustrating a service scheduling solution in the prior art;

FIG.2 is a block diagram illustrating the structure of an integrated cross-switching unit according to an embodiment of the present invention;

FIG.3 is a schematic diagram illustrating the connection of implementing 1+1 or 1:1 protection of the integrated cross-switching unit according to an embodiment of the present invention;

FIG.4 is a block diagram illustrating the structure of an integrated cross-switching unit according to another embodiment of the present invention;

FIG.5 is a block diagram illustrating the internal structure of the date service processing unit according to an

embodiment of the present invention.

Detailed Description of the Embodiments

FIG.2 is a block diagram illustrating the structure of an integrated cross-switching unit according to an embodiment of the present invention. The integrated cross-switching unit includes: a bus identification module, a cross-connecting module, a mapping/de-mapping module, an encapsulation/de-encapsulation module, and a packet scheduling module; the bus identification module is connected with a conventional SDH line unit and a data service processing unit, for identifying service source and transmitting the service to the corresponding following parts to implement scheduling.

For conventional TDM service, the cross-connecting module schedules TDM data of one time slot to another time slot through space-division or time-division, implementing cross-scheduling; for data service from the conventional SDH line unit, which is probably mixed with TDM service, the time slots corresponding to the data service are scheduled to the mapping/de-mapping module by the cross-connecting module, pass the mapping/de-mapping module and the encapsulation/de-encapsulation module in turn, and get to the packet scheduling module, implementing final scheduling.

The service from the data service processing unit enters the integrated cross-switching unit via backplane packet bus. The bus identification module of the integrated cross-switching

unit identifies the backplane packet bus according to the type of the single board plugging in the slot corresponding to the main control unit, and extracts the data packets from the bus, and transmits them to the packet scheduling module to implement scheduling. The scheduled data can be transmitted to the data service processing unit via the packet bus, or can get to the backplane TELECOM bus through the mapping/de-mapping module, the encapsulation/de-encapsulation module and the cross-connecting module and then get to the line unit, in order to implement the processing of packet over SDH.

The mapping/de-mapping module is used to load data frames into a virtual container or a virtual container group, or extracts data frames from a virtual container or a virtual container group. Virtual container group refers to multiple virtual containers bound together through adjacent concatenations or virtual concatenations. In the embodiment of the present invention, the mapping/de-mapping module of the integrated cross-switching unit supports multi-granularity virtual container or virtual container group, so that service scheduling between virtual containers or virtual container groups with different granularity can be implemented, for example, from VC12 to VC3. For SDH, the granularity of virtual container includes but is not limited to VC12, VC3 and VC4. For SONET (synchronous optical network), the granularity of virtual container includes but is not limited to VT1.5, STS-1, STS-3C etc.

When virtual concatenation is adopted, the mapping/de-mapping module also implements LCAS (Link Capacity

Adjustment Scheme) protocol.

The encapsulation/de-encapsulation module is used to implement data link layer encapsulation/de-encapsulation of data frames. The data link layer encapsulation is performed for frame alignment.

In the embodiment of the present invention, the encapsulation/de-encapsulation module of the integrated cross-switching unit supports multiple encapsulation protocols including: GFP (Generic Framing Procedure), LAPS (Link Access Procedure-SDH), HDLC (High-level Data Link Control) etc., so that scheduling of service with different encapsulations can be implemented. Different encapsulation protocols can be respectively configured for each channel.

Besides common encapsulation/de-encapsulation function, for data streams of linear frames adopting GFP, the encapsulation/de-encapsulation module can implement service scheduling based on CID information in the extended header of GFP frame. That is, for GFP frames from different physical channels (an individual virtual container or virtual container group), the encapsulation/de-encapsulation module can find CID field in the extended header of GFP frame, and forwards the data frames with the CID to corresponding physical channel (an individual virtual container or virtual container group) according to network configuration. This scheduling mechanism can save cost of encapsulation/de-encapsulation and improve speed of processing.

The packet scheduling module implements packet scheduling based on label. For a data service frames (de-encapsulating the GFP frame) from different channels, the packet scheduling module finds the label information in the data service frames, and forwards the data frames with the labels into the corresponding channels according to network configuration. Here the label information can be configured differently according to different channels and can exist in different positions in the data frames according to different protocols. The label information can be found according to pre-configured or default offset position. Particularly, the label information can be 802.1Q VLAN label, q-in-q stacked VLAN label, or MPLS L2 VPN label.

Since the position of the integrated cross-switching unit in the network is very important, an embodiment of the present invention aims to provide a 1+1 or 1:1 protection, as shown in FIG.3.

When 1+1 protection is provided, the line unit and the data service processing unit copy the service to the integrated cross-switching units A and B, so the service received, processed and transmitted by the integrated cross-switching units A and B are completely same. The line unit and the data service processing unit receive service streams from the integrated cross-switching units A and B, and select either of them to perform a processing based on the service streams.

When one of the integrated cross-switching units A and B goes wrong, supposing the faulted one is A, then the integrated

cross-switching unit A reports to the control unit, and the control unit instructs the line unit and the data service processing unit to select the service streams from the integrated cross-switching unit B. In a different system, the line unit or the data service processing unit can determine the signal is normal or wrong at its receiving end by itself and select the normal one. Here the breakdown includes: performance deterioration or alarm of virtual container overhead detected by the mapping/de-mapping module in the integrated cross-switching unit, performance deterioration or alarm in encapsulation detected by the encapsulation/de-encapsulation module, performance deterioration or alarm of data frames detected by the packet scheduling module, and failure of circuit such as unit power supply, clock etc.

When 1:1 protection is provided, the service received, processed and transmitted by the integrated cross-switching units A and B are different from each other when they work normally, and moreover the service possibly has priority. When one of the integrated cross-switching units A and B goes wrong, supposing the faulted one is A, then the integrated cross-switching unit A reports to the control unit, and the control unit instructs the line unit and the data service processing unit to switch the service as required to be protected transmitted to A to the service scheduling unit B, and the switched service possibly substitutes for part of the service being processed in B. Which service in B can be substituted is pre-configured, and it may be the service with low priority. In a different system, the line unit or the data

service processing unit can determine the signal is normal or wrong at its receiving end by itself and select the normal one. Here the breakdown includes: performance deterioration or alarm of virtual container overhead detected by the mapping/de-mapping module in the integrated cross-switching unit, performance deterioration or alarm in encapsulation detected by the encapsulation/de-encapsulation module, performance deterioration or alarm of data frames detected by the packet scheduling module, and failure of circuit such as unit power supply, clock etc.

Another embodiment of the present invention provides an integrated cross-switching unit, comprising: a bus identification module, a high-order cross-connecting module, a low-order cross-connecting module, a high-order mapping/de-mapping module, a low-order mapping/de-mapping module, a high-order encapsulation/de-encapsulation module, a low-order encapsulation/de-encapsulation module, a high-order packet scheduling module, and a low-order packet scheduling module. The structure of the integrated cross-switching unit is shown as FIG.4. The capacity of cross-switching is expanded through separation of the high-order and low-order cross-switching. The high-order cross-connecting module schedules the service as required for low-order processing to the low-order cross-connecting module, which implements scheduling of low-order service, and scheduling the service as required for packet scheduling to the low-order mapping/de-mapping module. And the service is in turn processed by the encapsulation/de-encapsulation module and/or the packet

scheduling module. The high-order cross-connecting module implements scheduling of high-order service, and the particular procedure of scheduling is as the same as the procedure implemented by the structure in FIG.2, which will not be repeated here. For SDH and SONET, high-order service and low-order service have different definitions, and in general, the high-order service includes speeds of VC3 and VC4; while the low-order service includes speeds of VC3, VC12, VT1.5, etc.

With the provision of the integrated cross-switching unit, the data service processing unit can be made relatively simple, i.e., only adaptation between the service and the backplane packet bus and addition of label information as required for switching should be implemented. While the complicated service scheduling function, encapsulation function and mapping function are implemented by the integrated cross-switching unit. The block diagram of the data service processing unit is shown as FIG.5. In different applications, other complicated functions can be added in the data service processing unit.

Here the data service processing unit includes but is not limited to Ethernet service processing unit, SAN service processing unit, ATM service processing unit, FR service processing unit, POS service processing unit, etc.

The above description is preferred embodiments of the present invention, but does not intend to limit the protection scope of the present invention. It is apparent that various modifications and substitution disclosed within the scope of the present invention by those skilled in the art should be

within the disclosed scope of the present invention. Therefore, the protection scope of the present invention should be defined by the appended claims.